
Space Weather Technical Forecast

Issued on Wednesday, 17 January 2024 at 12:41 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with only minor C-class flares. There are fourteen sunspots on the disc, however these are all relatively small and simple or mature regions. The most notable development was with an emergent spot near the southwest, AR3558, however this, and also nearby AR3540 and AR3541 are increasingly difficult to assess and soon moving off the disc. A small, new region rotated on the northeast limb, but any analysis of this also remains difficult. Any other development on the disc, including around the slightly larger spots AR3545 in the west, AR3549 in the south-centre and AR3553 in the northeast, remained limited.

No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Slow wind conditions persisted, with speeds observed by ACE and DSCOVR at background to slightly elevated 350-450km/s, although DSCOVR is likely over-estimating the peak values. Density has been at or below average. The interplanetary magnetic field (IMF), Bt, has been weak throughout, below 7nT. The north-south component, Bz, was weak but mainly negative (southward), ranging +6nT to -4nT. Phi angle was variable with spells of negative (toward the Sun) and positive (away from the Sun). Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background. GOES16 high energy (greater than 2MeV) electron flux was at background. The associated 24-hour fluence was well below Active (1e8 integrated pfu). The 17/0000 UTC 24-hour integrated fluence observation was 1.08e6 integrated pfu.

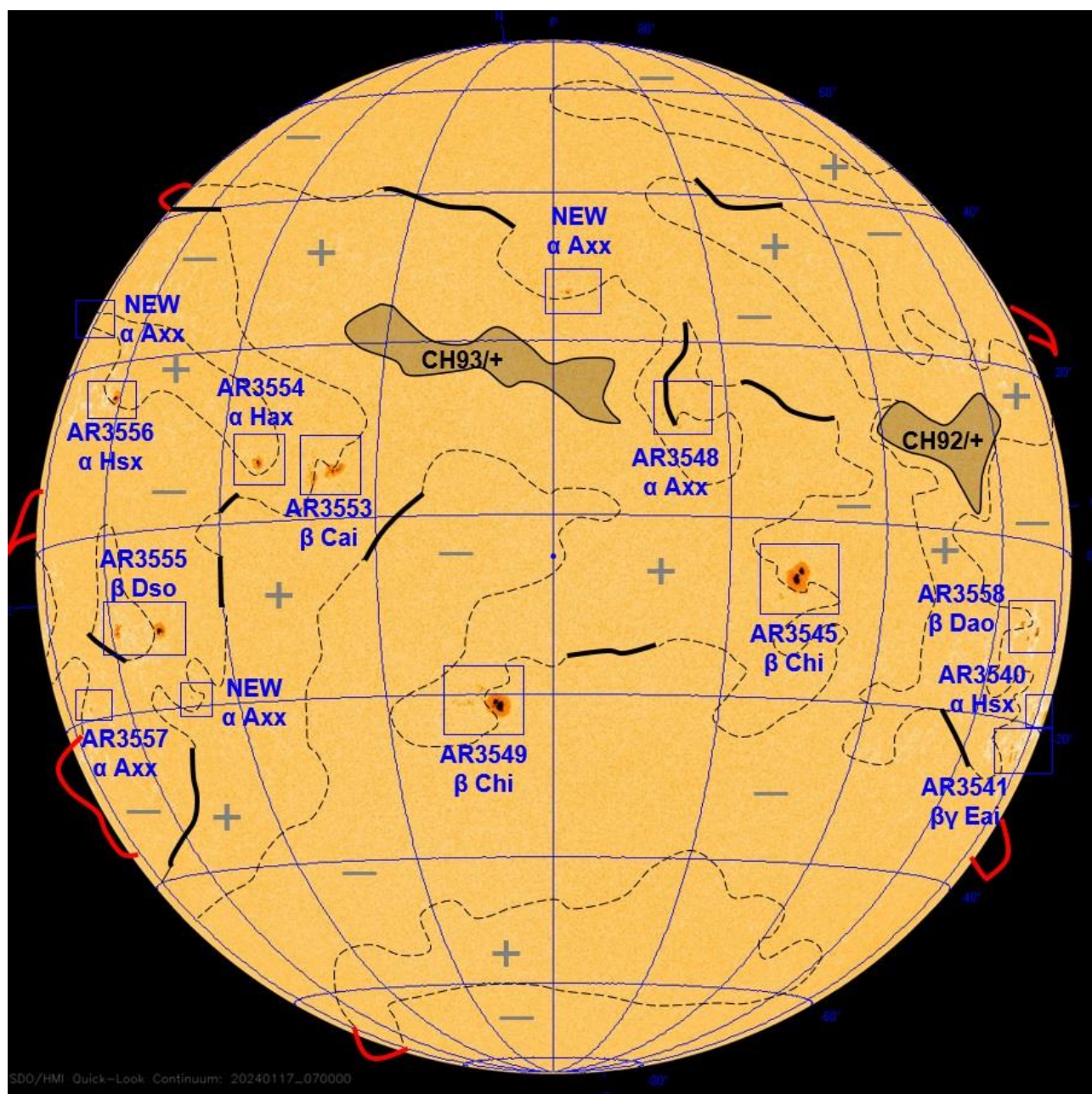
Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is expected, but with a chance of rising to Moderate due to isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Transition into the fast winds from CH92/+ is expected later day 1 (17 Jan), then easing later day 2-3 (18-19 Jan). Further slight enhancement then possible day 4 (20 Jan) from CH93/+ fast winds. Only limited enhancements are expected, with solar winds peaking slightly elevated, around 450km/s. Generally Quiet geomagnetic activity is expected, however onset of the fast winds will likely bring a spell of Unsettled (Kp3) with a chance of an isolated Active interval (Kp4), mostly likely late day 1 (17 Jan) or day 4 (20 Jan).

Energetic Particles / Solar Radiation: High energy proton flux will most likely remain at background levels. The high energy electron flux is forecast to be background at first, but may rise to Moderate at times by day 3 due to the onset of the fast winds of CH92/+. The associated fluence is expected to remain below the Active threshold.

Figure 1. Solar Analysis Valid 17/0800 UTC.



Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

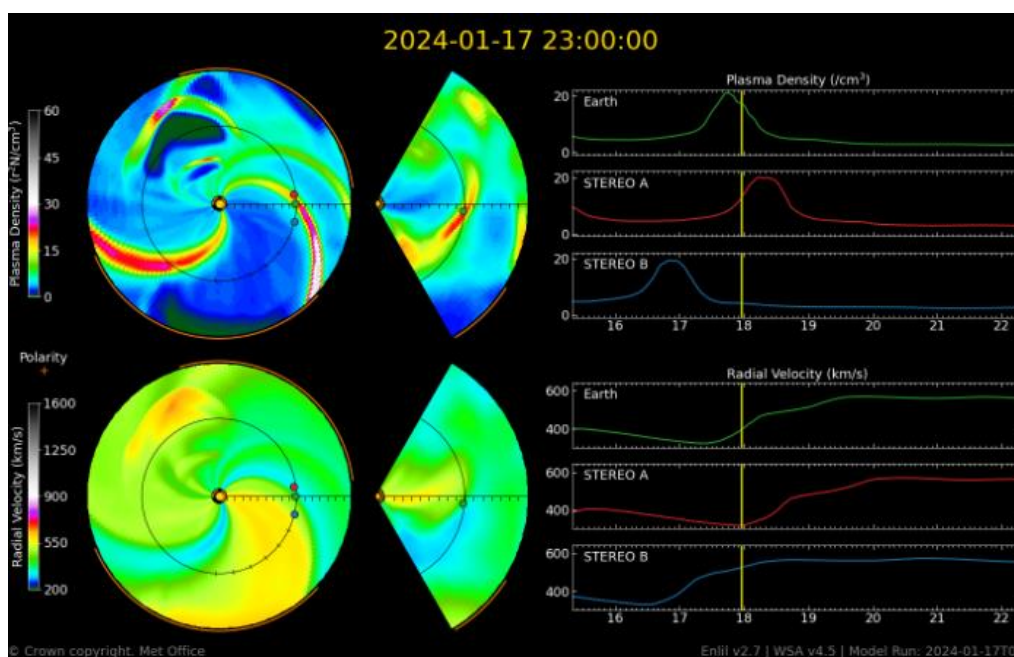
There are no Earth-directed CMEs.

Slow wind conditions at first with background speeds, are expected to transition to the fast wind of CH92/+ later on day 1 and into day 2 (17-18 Jan). Slightly elevated speeds of 400-500km/s are likely, perhaps easing a little days 2-3 before a further fast wind enhancement, and return of slightly elevated speeds, is possible from CH93/+ on day 4 (20 Jan). Day 1 (17 Jan) onset is in agreement with current MOSWOC Enlil forecast, although this then maintains these speeds through the rest of the period, which is not expected, with a more uncertain transition into the CH93/+ HSS.

Geomagnetic activity is likely to be largely Quiet (Kp0-2), however onset of the fast winds will likely bring a spell of Unsettled (Kp3) with a chance of an isolated Active interval (Kp4). These most likely day 1 (17 Jan) or day 4 (20 Jan).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC Enlil



Radio Blackouts - X-Ray Flares:

Low activity is likely to continue, with a chance of isolated M-class flares.

There are currently fourteen sunspots on the visible disc, three of which are unnumbered and the majority small and simple. AR3541 and AR3540 are difficult to assess due to their proximity to the southwest limb. Nearby AR3558 is also difficult due to its location, but was a recently emerging region, with ongoing development. These three regions will soon rotate over the southwest horizon. Also of note is AR3545, which having lost its positive trailer spots, has redeveloped small positive spots nearer the main dominant leader. Slight growth is evident in AR3553 while AR3558 is maturing into a simple bipolar region. A new region, rotating onto the northeast disc appears to bright in SDO aia-94 imagery, suggesting some elevated activity, however any sunspot remains difficult to analyse

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	35	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES-16/18 X-ray flux



Solar Radiation Storms - (High Energy Protons):

GOES18 High energy (greater than 10MeV) proton flux is currently at background and expected to persist at this level through the period. Given the number of sunspots, including those soon to rotate off the southwest limb, there remains a slight chance of proton flux increasing given the occurrence of any notable flares. This brings a very slight chance of exceeding the S1 Minor Radiation Storm thresholds.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	5	5	5	5
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2MeV) as measured by GOES16 at GEO is currently at background. Any fast wind onset from CH92/+ on day 1 and into day 2 (17-18 Jan) will bring potentially bring a slight rise to observed flux, rising to Moderate at times day 3 or 4 (19-20-Jan). Any enhancement is expected to be limited, however, with the onset of the fast winds of CH93/+ on day 4 (20 Jan) suppressing any increased flux, with observations declining back towards background

The associated 24 hour fluence is expected to remain below the Active level, albeit with a rising trend by day 3 (19 Jan) due to the HSS onset. Until this occurs, REFM is providing good guidance for at least the next 24 hours.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	5
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1